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THE BIOGRAPHY OF STEPHEN HALES,
D. D., F. R. S.

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Just as the name of William Harvey stands foremost in [185] that chapter of physiology which deals with the circulation, so does the name of Stephen Hales begin the sub-chapter on hæmodynamics.

In this sub-chapter the first important conception to be grasped by the student is that of the blood pressure, and the first experiment is designed to demonstrate its existence and to estimate its amount. This experiment is familiar to us all. It consists in connecting the femoral artery of a dog to a long glass tube. Into this tube the blood mounts up and up to a height of five or six feet and then oscillates up or down with each contraction or relaxation of the heart. Such a tube, as the student already knows, is called a manometer, and he is then told that this particular form of manometer, so simple in principle and construction, is called the "Hales manometer" after its inventor, a certain Dr. Hales. Thus every student of physiology becomes acquainted with the name of Hales, but to most of us it is a name and nothing more.

Stephen Hales was born in 1677. His grandfather, Sir Robert Hales, of Beckesbourn in Kent, was made baronet by Charles II. Sir Robert's eldest son, Thomas, married Mary, the daughter and heiress of Richard Wood. They had many children, and Stephen was their sixth son.

Of Stephen's boyhood there is nothing known. In his nine-

¹ Read before the Johns Hopkins Hospital Historical Club. April 20, 1903.

[185] tenth year he was sent to Cambridge and was entered a pensioner of Corpus Christi College under the tuition of Mr. Moss, the future dean of Ely. Having taken the degree of Bachelor of Arts, he was pre-elected into a fellowship into which he was admitted in the following year. In the same year (1703) he obtained his degree of Master of Arts. Some time afterwards he entered into orders and became a Bachelor of Divinity in 1711. During his residence in the college, a period of about twelve years (1696-1708 or 1709), he applied himself with great zeal to the study of natural and experimental philosophy.

[186] In William Stukeley,² afterwards M. D., F. R. S., who came in 1704 to live in Corpus Christi College, Hales seems to have found a very congenial companion, though Stukeley was the younger by ten years. Together the two used to ramble over Gogmagog Hills and the bogs of Cherry-Hunt-Moor to gather simples. One carried in his pocket Ray's Catalogue of Plants, to which Stukeley, who was a ready draughtsman, added a map of the country to guide them in their walks. Sometimes they collected fossils from the gravel and chalk pits and sometimes hunted butterflies, having contrived an instrument for taking them. The two friends also studied anatomy together, dissecting frogs, dogs and other animals; while Hales devised an ingenious method of obtaining a preparation of the lungs in lead. They moreover studied chemistry and "repeated many of Mr. Boyle's experiments" and prepared various substances, "some of use, some of curiosity."

At this time Vigani,³ of Verona, the first professor of chem-

² William Stukeley, 1687-1765. In his undergraduate days he "went," he says, "frequently asimpling, and began to steal dogs and dissect them" and once when at home, he "made a handsome skeleton" of an aged cat. Hales and Dr. J. Gray of Canterbury, were his botanical associates and he made large additions to Ray's *Catalogus Plantarum circa Cantabrigiam*.—D. N. B.

³ John Francis Vigani, 1650?-1712, born in Verona; probably came to England about 1682, to Cambridge about 1683, where he gave private lessons in chemistry and pharmacy. In 1703 a grace was passed by the senate for "investing with the title of professor of chemistry John Francis Vigani, a native of Verona, who has taught chemistry with reputation for twenty years previously."—D. N. B.

istry at Cambridge, was lecturing at Queen's College Cloysters, [1861] and thither Hales and Stukeley used to repair, and were also witnesses of the chemical operations which Vigani was accustomed to perform in a room in Trinity College which had formerly been the laboratory of Sir Isaac Newton. Hales was also a student of astronomy and constructed a brass machine for demonstrating the movements of the planets, and of this Stukeley made a sketch.

About 1710 Hales was made perpetual curate of Teddington. He afterwards accepted the living of Porlock, in Somerset, vacating his fellowship in so doing, but this living he soon exchanged for that of Farrington, in Hants. Teddington he made his home, though he appears to have occasionally resided in Farrington.⁴

The date of his marriage seems to be uncertain. His wife was Mary, daughter and heiress of Dr. Newce, rector of Halisham. In 1721 Mary died,⁵ leaving no children. Hales never married again.

In 1718 Hales was elected Fellow of the Royal Society and became a member of the council of that body in 1727. In 1732 he was appointed one of the trustees of the newly-founded colony of Georgia.⁶ In 1733 the University of Oxford conferred upon him the honorary degree of D. D., which was the more significant in that Hales had pursued all his studies at Cambridge. In 1739 he received the Copley medal. In 1750, on the death of Frederick, Prince of Wales, he was appointed, without his solicitation or even knowledge, clerk of the closet and almoner of Her Royal Highness the Princess Dowager. In 1753 he became one of the eight foreign members of the French Academy in the place left vacant by the death of Sir Hans Sloane, president of the Royal Society.⁷

⁴ Letter preserved in the Library of the Royal Society, F. D.

⁵ See L. L., III, 507.

⁶ In 1734, Hales published a sermon which he had delivered at St. Brides, before the rest of the trustees of the colony, his text being Gal. VI, 2.

⁷ "Stephen Hales, D. D., is elected member of the Royal Academy of Sciences at *Paris*, in the room of Sir *Hans Sloane*, Bart. Deceased." G. M., Feb., 1757, XXIII, 103.

[186] The work and writings of Hales embrace a very broad field, which includes chemistry, botany, physiology, medicine and public hygiene, not to mention sermons and temperance tracts. In 1719 he reported before the Royal Society some experiments which he had lately made on the effect of the sun's warmth in raising the sap in trees. This procured him the thanks of the Society, which also requested him to continue his research. "With this request," writes the biographer,⁸ "which was like the charge given by Pharaoh's daughter to the mother of Moses, to take care of her son, Hales complied with great pleasure, and on the 14th of June, 1725, he exhibited a treatise in which he gave an account of his progress." At the request of the Society this treatise was published and appeared in 1727 under the following title: "Vegetable Staticks; or, an account of some statical Experiments on the Sap in Vegetables: being an Essay towards a Natural History of Vegetation; also a Specimen of an Attempt to analyse the Air by a great Variety of chemio-statical Experiments, which were read at several Meetings of the Royal Society." The "Vegetable Staticks" was so well received that a second edition was published in 1731. In the preface of this edition the author promised to add a second volume, and in 1733 he published his second famous work, entitled "Statical Essays: containing Hæmostaticks, or an Account of some Hydraulick and Hydrostatical Experiments made on the Blood and Blood-Vessels of Animals; also an Account of some Experiments on Stones in the Kidney and Bladder; with an Enquiry into the Nature of these anomalous concretions. To which is added an Appendix containing Observations & Experiments relating to several Subjects in the first Volume." These two books were again edited under the title, "Statical Essays, Vols. I & II."

Through the "Statical Essays" Hales came to have an international reputation, for not only was the first volume translated into French by Buffon, and the second into the

⁸ Peter Collinson, 1694-1768, F. R. S., 1728; naturalist, antiquary, and merchant; Quaker.

same language by Boissier de Sauvages (1744), but before [186] long there appeared German and Italian translations.⁹

If one were required to state the essential and distinguishing characteristics of these essays, the unhesitating reply would [187] be that the work which they describe is quantitative. In everything that Hales did, one sees this constant effort to be exact. Qualitative results were never sufficient; Hales must needs weigh and measure everything, and every phenomenon must be expressed numerically so as to serve as the basis of calculations and thus lead to new discoveries.

It will be remembered that Hales studied chemistry under Vigani and that Vigani was the first professor of chemistry at Cambridge. In fact, Hales' life fell very early in the history of scientific chemistry, in that period when experimentation, though often suggestive, is usually indefinite and always incomplete.¹⁰ Hales made a careful study of gases, or, as he called them, "air." To him air was an element which entered into the composition of a surprising number of substances, and so he studied the generation and absorption of "air" during distillation, fermentation and many other chemical processes. In his experiments he must have prepared hydrogen, oxygen, hydrochloric acid, carbon dioxide and ammonia, and though they were all "air" to him, he introduced some important improvements in the way of chemical apparatus and manipulations, and was perhaps the first chemist to employ quantitative methods.¹¹

With respect to the purely botanical part of the "Statical

⁹ These works contained copious notes by the translators and to the volume on Hæmostatics two memoirs by de Sauvage had been added one on inflammation and one on fevers. The two volumes were re-edited in 1779 as one book. In 1748 the two French works were translated bodily (memoirs, notes and all) into German. In 1750, M. A. Ardinghelli published her translation, *Emastatica*, in Naples; the text was translated from the English; the notes from the French of de Sauvage.

¹⁰ "He (Hales) had learned to interrogate but not to cross examine nature." F. H. Butler: *History of Chemistry*, Encyclo. Brit.

¹¹ See Herman Kopp: *Geschichte der Chemie*. Braunschweig, 1845.

[187] Essays," suffice it to refer to a statement of Sachs. This well-known botanist writes that in the revival of plant physiology which took place in the eighteenth century, the work of Hales was the most original and most important contribution.¹² It was in honor of Hales that John Ellis, the "bright star in Natural History," as Linnaeus has called him,¹³ named a newly discovered genus of plants *Halesia*.¹⁴

The contributions of Hales to animal physiology are many and important. His experiments in this field are described partly in the first volume of the Essays, but chiefly in that section in the second volume which is devoted to hæmodynamics. A discussion of this part of Hales' work will, however, be reserved for another communication.¹⁵

In 1739 he published an octavo volume entitled: "Philosophical experiments: containing useful and necessary instructions for such as undertake long Voyages at Sea; showing how Salt-water may be made fresh, wholesome, and how Fresh Water may be preserved sweet; how Biscuits, corn, &c., may be secured from the Weavel, Maggots, and other Insects; and Flesh preserved in Hot Climates by salting Animals whole; to which is added an account of Experiments and Observations on Chalybeate or Steel-waters, with some Attempts to convey them to distant places, preserving their virtues to a greater degree than has hitherto been done; likewise a proposal for cleansing away Mud, &c., out of Rivers, Harbours, and Reservoirs." This work, which contained so many useful instructions for voyagers, was dedicated to the Lords of the Admiralty.

¹² F. D.

¹³ D. N. B.

¹⁴ Title: "Of the Plants *Halesia* and *Gardenia*." "In a letter from John Ellis, Esq., F. R. S., to Philip Careret Webb, Esq., F. R. S. The intent of the letter is to exhibit the characters of two new genera of plants growing in Mr. Webb's garden, which Mr. Ellis calls after Dr. Hales of Teddington and Dr. Garden of South Carolina." P. T., XI, 508.

Francis Darwin appears to be in error in the statement that John Ellis was governor of Georgia. The governor was Henry Ellis, F. R. S., arctic explorer and hydrographer, also governor of Nova Scotia.

¹⁵ See Bulletin of the Johns Hopkins Hospital for July, 1904.

In the same year he reported to the Royal Society an ac- [187] count of some "further experiments towards the discovery of a medicine for dissolving the stone in the kidneys and bladder, and preserving meat in long voyages," and it was for this that he received the gold medal of "Sir Godfrey Copley's donation." In the following year he published an account of some experiments and observations on Miss Stephens' medicines for dissolving stone, in which their dissolving power was inquired into and demonstrated. This work on stone was subsequently translated into French.¹⁶

The contributions of Hales to the "Philosophical Transactions" were numerous and dealt with a great variety of topics. Besides those which are mentioned elsewhere in this article the following may be enumerated:

A Method of conveying Liquors into the Abdomen during the operation of Tapping. IX, p. 8.

A Proposal to bring Small Passable Stones Soon and with ease out of the Bladder. IX, p. 159.

Remarks on Dr. Cromwell Mortimer's paper on a new metallic thermometer. IX, p. 407.

A Proposal for Checking in some Degree the Progress of Fire. IX, p. 498.

Remarks concerning some Electrical Experiments. IX, p. 534.

Of the strength of several of the principal Purging Waters, especially that of Jessop's Well. X, p. 48.

Of some Trials to keep Water & Fish sweet, with Lime-water. X, p. 551.

Of the great Benefit of Blowing Showers of Fresh Air up through Distilling Liquors. X, p. 635.

Of Some Trials to cure the Ill Taste of Milk which is occasioned by the Food of Cows, either from Turnips, Cabbages, or Autumnal Leaves, &c. Also to Sweeten Stinking Water. X, p. 642.

¹⁶ "Etat de la Medicine, etc., par M. Clifton," translated by M. l'Abbé des Fontaines, "avec les Espériences sur le Remede de Mlle. Stephens, fait par M. Hales," etc., translated by M. Cantwell of the Royal Society, doctor of the Faculty of Montpellier. Paris, 1742.

[187] Whenever these papers seemed to him to be of value to the public or to deal with topics of general interest, he would
[188] publish a popularized version in the *Gentleman's Magazine*.¹⁷ But besides these abstracts this magazine contains numerous articles from his pen, of which the following are the more important:

A description of a Back-Heaver, which will winnow and clean corn, both much sooner and better, than by the common methods of doing it. July, 1745, XV, 353.

A Description of a very great Improvement which is made to the Back-Heaver; which will not only winnow corn much sooner and better than any other methods hitherto used; but will also clean and clear it of very small Corn, Seeds, Blacks, Smut Balls, &c., to such perfection as to make it fit for Seed Corn. July, 1747, XVII, 310.

A Description of a Sea Gage, to measure unfathomable Depths. May, 1754, XXIV, 215.

A Proposal for the more speedily and effectually curing Men, Ships, and Goods, of Pestilential Infection. Dec., 1754, XXIV, 543.¹⁸

Rational and easy method to purify the Air, and regulate its heat in Melon-Frames and hot Green-houses. April, 1757, XXVII, 165.

The year 1741 is ever memorable in the history of Hygiene. for it was in this year that three persons of very different stations in life conceived the idea of constructing ventilators. These persons were Sutton, a coffee-house keeper in Aldersgate Street; Martin Triewald, captain of mechanics to the King of Sweden, and the Rev. Dr. Hales.

The methods devised by Hales and Triewald seem to have been identical, and the history of their invention is told by Hales in his book on Ventilators published in 1743. From

¹⁷ See G. M., July, 1755, XXV, 310. April, 1747, XVII, 200. March, 1756, XXVI, 130. December, 1749, XIX, 554. February, 1756, XXVI, 78. September, 1757, XXVII, 410. November, 1757, XXVII, 503.

¹⁸ The method consisted essentially in fumigation by means of burning a mixture of brimstone and charcoal. Persons subjected to the fumes were to have their faces properly covered to prevent suffocation.

the introduction of this work, it appears that in the beginning [188] of September, 1740, Hales wrote to Dr. Martin, the physician to Lord Cathcart, the general of the forces which lay embarked at Spithead, for an expedition in America, to propose (besides the usual sprinkling between decks with vinegar) the hanging up very many cloths dipped in vinegar in the proper places between decks, in order to make the air more wholesome: and in case an infectious distemper should be in any ship, to cure the infection with fumes of burning brimstone. "It was from these considerations, which often recurred to my Thoughts, that it occurred to me in the March following that large Ventilators would be very serviceable, in making the Air in Ships more wholesome; this I was finally so fully satisfied of, that I immediately drew up an account of it; several coppies of which were communicated, both by myself and others, to many Persons of Distinction and Members of the Royal Society: before whom I laid a large Account of it

"November the 6th following Martin Triewald, Captain of Mechanics *and Military Architect to the King of Sweden, and Fellow of the Royal Society at London, in a Letter to Cromwell Mortimer, M. D., and secretary of the Royal Society*, says that this Spring he had invented a Machine, for the use of his Majesty's Men-of-War, which went to block up Petersburg, in order to draw out the bad Air from under their Decks, the least of which does exhaust 36172 cubick Feet of Air in an Hour "

"It was a very extraordinary Circumstance that two Persons at so great a distance from each other, without getting a Hint of it, one from the other, should happen to hit on inventing a like useful Engine."

For this invention Triewald was granted a privilege for life by the King and Senate of Sweden. He then wrote a "deduction" on the usefulness of ventilators which the King caused to be distributed among his naval officers. This "deduction" was read before the Royal Society in 1742. In it Triewald recommends the use of ventilators "in Hospitals and Barracks for the sick, Men-of-War and Hospital Ships."

The book, of which the introduction above quoted forms a

[188] part, was dedicated by Hales to "the Commission for executing the office of Lord High Admiral," and in the list of its members is found the name of the Right Honourable Lord Baltimore. An idea of its contents may readily be obtained from its very lengthy title, which is as follows: "A Description of Ventilators: whereby Great Quantities of Fresh Air May with Ease be conveyed into Mines, Goals, Hospitals, Work-Houses and Ships in Exchange for their *Noxious Air*. An Account of their GREAT USEFULNESS in many other Respects: As in Preserving all Sorts of Grain Dry, Sweet, and free from being Destroyed by WEAVELS, both in GRAIN-ARIES and SHIPS: And in Preserving many other Sorts of Goods. As also in drying, CORN, MALT, HOPS, GUN POWDER, &c., and for many other useful purposes."

The Hales ventilators were nothing more than ingeniously contrived bellows which sucked the foul air from the rooms or spaces to be ventilated and blew it out of doors. When large, these bellows were worked by means of a wind-mill; when small, by hand. The ventilator fixed in Newgate by order of the Lord Mayor and Aldermen of London was a large one and was connected by a system of tubes with twenty-four wards. It is figured and described in detail in the *Gentleman's Magazine*.¹⁹

Not content with playing the part of a mere inventor, Hales added to that role that of the philanthropist, for seeing that it would be of great benefit to humanity, he wrote constantly on the subject and used what influence he had to obtain the introduction of his ventilators. Success crowned his efforts. In a few years his ventilators had been put not only into Newgate and the Savoy prison,²⁰ but also into the Winchester [189] Gaol,²⁰ the Durham County Gaol,²⁰ then the Gaols of Shrewsbury,²¹ Northampton²¹ and Maidstone.²¹ The results were re-

¹⁹ "A description of Dr. Hales on Ventilators fixed in Newgate; where being worked by a Windmill they draw foul Air out of the several Wards; which were made by Mr. Stibbs, Carpenter in Fore Street, London Wall." G. M., April, 1752, XXII, 179.

²⁰ "An Account of the good Effects of Ventilators, in Newgate and the Savoy Prison." G. M., February, 1753, XXIII, 70.

²¹ "A further Account of the Success of Ventilators &c." G. M., March, 1754, XXIV, 115.

markable. During the first four months after their introduc- [189]
tion into Newgate, the death rate was reduced by more than
fifty per cent, while in the Savoy prison the rate fell from
fifty or a hundred per annum to one or two per annum.
Equally gratifying were the results at the smallpox hospitals.
This institution contained thirty-two rooms, each accom-
modating two patients, and here the mortality was soon re-
duced to two-thirds of what it had formerly been.

Meanwhile at the recommendation of the French Academy
the whole French fleet had been equipped with Triewald ven-
tilators and many English vessels had adopted those devised
by Hales. Excellent results followed, as can be seen from
such letters as the following, which was published in the
Gentleman's Magazine:²²

A letter from Captain Ellis, on his late Arrival from a Guinea
Voyage, to the Rev. Dr. Hales.

Sir,

Could anything increase the pleasure I have in a
literary intercourse with you, it would be to find that it answered
your end in promoting the publick good. . . . Those [venti-
lators] of your invention which I had were of singular service
to us; they kept the inside of the ship cool, sweet, dry, & healthy:
The number of slaves which I buried was very inconsiderable,
and not one white man of our crew (which was 34) during a
voyage of 15 months; an instance very uncommon. The 340
negroes were very sensible of the benefits of a constant ventila-
tion, and were always displeased when it was omitted. Even the
exercise had an advantage not to be despised among people so
much confined."

Ellis adds, however, that we must not forget that there are
other causes of sickness at sea, infections brought on board,
bad food and insobriety. On the last factor he dwells at some
length, and to the unusual sobriety of the crew he ascribes
some of their good health. His conclusion is as follows:
"Could I but see the immoderate use of spirituous liquors
less general, and the benefit of ventilators more known and ex-
perienced, I might then hope to see mankind better and hap-
pier."

²² G. M., March, 1754, XXIV, 114. See also G. M., August, 1750,
XX, 379.

[189] It was without doubt the receipt of such letters as these that prompted Hales to report before the Royal Society "On the Great Benefits of Ventilators in many Instances in Preserving the Health and Lives of People, in Slave and Transport Ships."²³

The *Gentleman's Magazine* also contains the following articles: On keeping corn sweet in heaps: Dec., 1745, XV, 640; Dr. Hales' *method to keep corn sweet in sacks*: July, 1745, XV, 354; *An Account of several methods to preserve CORN well by VENTILATION*: June, 1746, XVI, 315.

The last of the articles which have just been enumerated was accompanied with plates and contained a careful and minute description of the construction of granaries, with calculations regarding the size of the ventilator and the amount of air required for drying a certain amount of a given kind of grain in layers of such a depth in granaries of such a size and so forth, all this showing his painstaking accuracy and his detailed knowledge of the subject.

The ventilator which was invented by Sutton, the coffee-house keeper above mentioned, was "of another construction,"²⁴ being designed "to draw off the foul air on board ships by means of the cook-room fire."²⁴ Sutton did not fully recognize the importance of his idea, so that it would have been forgotten had it not been for Dr. Mead, who brought it to the attention of the Royal Society. The method was so simple and satisfactory that it could not but replace in part at least the method of Hales. But, as the editor of the *Gentleman's Magazine* says, "The public, however, is not the less indebted to the ingenuity and benevolence of Dr. Hales, whose ventilators came more easily into use for many purposes of the greatest importance to life, particularly for keeping corn sweet, by blowing through it fresh showers of air, a practice very soon adopted by France, a large granary having been made under the direction of Du Hamel, for the preservation of corn in this manner, with the view to making it a general practice."²⁵ Here the editor refers to Duhamel du Monceau,²⁵

²³ P. T., X, 641.

²⁴ P. C., page 275.

²⁵ Henri Louis Duhamel du Monceau, 1700-1782.

F. R. S., the celebrated French botanist and agriculturist, [189] who, at the suggestion of Hales, equipped one of the public granaries with a wind-mill and ventilators to draw up air through the grain.

It was probably through Duhamel's influence that Hales persuaded Louis XV to introduce his system of ventilating into the French prisons in which British soldiers were confined.²⁶ On this occasion, writes the chronicler, "the venerable patriarch of Teddington was heard merrily to say 'he hoped no body would inform against him for corresponding with the enemy.'"²⁷

Among Hales' numerous contributions to the literature of stone in the bladder and kidney, one is of special interest as showing his method of dealing with this question and his zeal in exposing quackery. It is a letter to the editor of the *Gentleman's Magazine*,²⁸ which runs thus:

"Mr. Urban, If you please to put the following Remarks on the *Liquid Shell* into your next Magazine, you will do good service to the publick. I am, Sir, &c.

"Some Remarks on the *boasted* Liquid Shell. The newspapers having frequently repeated a long advertisement in praise of the *Liquid Shell*, as a powerful dissolvent for the stone and gravel, I thought it of importance to enquire, by proper tryals, whether it had that boasted efficiency or not; and, if not, to caution people against throwing away their money, and hazarding their [190] lives, by the use of an unefficacious medicine.

"Having therefore procured some of the *Liquid Shell*, which is a clear transparent liquor, I put into it a human stone formed in the urinary passages, upon which a very white sediment precipitated; and there was a like white sediment when a few drops of spirit of harts-horn were dropped into the same liquor; which fully proves that it was in both cases the lime of burnt shell, and not the parts of the dissolved stone as is pretended; for there was no stone put in with the spirit of harts-horn. Besides this precipitated matter is much too white for any part of dissolved stones.

* * * * *

"And, whereas, it is said in the advertisement, 'That, if the

²⁶ See Michaud: *Biographie Universelle*, article on Hales by Lefebvre Cauchy.

²⁷ F. D.

²⁸ G. M., October, 1746, XVI, 520.

[190] stone be put into a vial of the Liquid Shell, in a moderate sand heat, it will in a few hours be dissolved or broken to pieces:’ On the contrary, it has been found, that, on putting human stones, of different degrees of hardness, into a vial of the Liquid Shell, they have *not* been dissolved, *nor* broken in pieces, though they continued in that state, not a few hours only, but many days; the last four hours of which time, the vial of Liquid Shell was put into scalding hot water, ”

“ Soap lie,” he then states, is a powerful solvent of stones, but on evaporating the medicine to dryness only a minute quantity of this material was obtainable, and he therefore concludes thus:

“ Hence we see how improbable it is that *this Liquid Shell* ‘given every four hours in the quantity of 70 drops in a dose,’ should have any efficiency to dissolve stones in the body,” especially since it has been shown that “three pints of lime water a day, with a considerable quantity of soap, have been found necessary to be taken, in order for any probability of success, (as may be seen in the *Edinburgh Medical Essays*) ”

Among the book notices for the following year is “Dissertation on the Liquid Shell pr. 6 d.”²⁹ This pamphlet, like the article in the *Gentleman’s Magazine*, was anonymous.

Dr. Holmes has made us all familiar with the subject of Bishop Berkeley’s “Tar Water.” In the words of a wag writing in the *Gentleman’s Magazine*,³⁰

“ To ev’ry med’cine is assigned its part,
“ *Sena* is purging, *saffron* warms the heart;
“ Blood sweet’ning juice to *sassafras* is given,
“ To *tar drink*—every virtue under heaven.”

On the subject of tar water Hales shows a praiseworthy caution. He does not deny its efficacy, but he does not advocate its use. His only publication in the *Gentleman’s Magazine*³¹ is a letter received by him from Bishop Berkeley, upon the contents of which he makes no comment. In the book which he wrote on this subject, he confines himself entirely to the chemistry and preparation of tar water. This book, which bears the following title: “An Account of some Experiments

²⁹ G. M., November, 1747, XVII, 548.

³⁰ G. M., February, 1747, XVII, 81.

³¹ G. M., February, 1747, XVII, 64.

and Observations on Tar-Water Wherein is shown the Quantity of Tar that is therein. Which was read before the Royal Society. By Stephen Hales, D. D., F. R. S.," closes with the following paragraph: "It is hoped that the Light given by these Researches, may be of use in Skillful Hands, for regulating and adapting the due Proportions of the acid and the oily Principles, to different Cases and Constitutions. This is the proper Province of the Physician, which I am in no ways qualified to meddle in."

Among the subjects which Hales regarded as of great importance was the liquor question. In a letter dated 1758, written by him to Mark Hildesley, Bishop of Sodor and Man, he speaks of having for the last thirty years borne public testimony against drams "in 11 different books and newspapers," and adds that this circumstance "has been of greater satisfaction to me than if I were assured that the means which I have proposed to avoid noxious air should occasion the prolonging the health and lives of a hundred millions of persons."³²

His most important pamphlets on this subject are entitled "A Friendly Admonition to Drinkers of Brandy and other Distilled Spirits" (published anonymously), and later, "Distilled Spirituous Liquors the Bane of the Nation." In his treatment of even these topics, the scientific bent of his mind is seen, for in the second of these pamphlets, he tries to arouse the interest of the landed gentry and the farming population on the ground that dram drinking decreases the appetite and lowers the demand for food. Then, not contented with anything but quantitative statements, he declares that according to his calculations the country loses £600,000 per annum owing to the distilleries in London alone.³³

We have considered Stephen Hales as a scientist and as a philanthropist, but the question now arises, What was going on in Teddington all this time? Did the charity of Dr. Hales begin at home?

History does not record any murmurs of neglect coming from his flock. It is even said that he made some of his

³² Butler: Life of Hildesley, 1799. F. D.

³³ F. D.

[190] women parishioners do public penance for irregular behavior.³⁴

We are told that the little church of St. Mary owed much to his care. He enlarged the church yard "by prevailing on the lord of the manor."³⁴ He superintended the building of a new tower and aisle, for which he contributed £200 out of the £592 which it cost.³⁵

Under his supervision the water supply of the parish was greatly improved, and Hales records in the parish register in a manner quite characteristic that the outflow was such as to fill two quart vessels in "3 swings of a pendulum, beating seconds, which pendulum was $39 + 2/10$ inches long from the suspending nail to the middle of the plumbet or bob."³⁴

"Peg" Woffington,³⁶ the celebrated actress, was one of his parishioners, and built and endowed an almshouse at Teddington, and at her death a tablet in her memory was placed in the north aisle of St. Mary's.³⁷

Hales' connection with the smallpox hospital is shown in [191] the title of an account of this institution which appeared in the *Gentleman's Magazine*.³⁸ This title reads as follows:

"Middlesex. *Of the County Hospital for the SMALL POX, the Duke of MARLBOROUGH and the Lord Bishop of WORCESTER, Presidents, Sir HUGH SMITHSON and Sir ROVER NEWDIGATE Barts. the Hon. Col. BOCKLAND and the Rev. Dr. HALES Vice-Presidents.*

"For several years Hales was honored with the esteem and friendship of his Royal Highness Frederick, Prince of Wales, who frequently visited him at Teddington, from his neighboring palace at Kew, and took a pleasure in surprising him in the midst of those curious researches into the various parts of nature which almost incessantly employed him."³⁹

His contemporaries admired his "social virtue and sweetness of temper" and "the constant serenity and cheerfulness of his mind."⁴⁰ Pope, who was his neighbor and of whose

³⁴ Parish register, F. D.

³⁵ L. L., III, 505, note 14.

³⁶ Margaret Woffington, born in Dublin, 1714, died, 1760.

³⁷ L. L., II, 506.

³⁸ G. M., June, 1747, XVII, 270.

³⁹ P. C., 277.

⁴⁰ F. D.

will Hales was one of the witnesses,⁴¹ was heard to say, "I [191] shall be very glad to see Dr. Hales; I always love to see him; he is so worthy and good a man."⁴²

To the end of his long life his mind was ever actively planning scientific experiments and benevolent enterprises. In November, 1760, his signature appears on the parish register for the last time. On Sunday, January 4, 1761, he died after a slight illness. His death was the occasion of the following article, which appeared in the January number of the *Gentleman's Magazine*:⁴³

"The following Character of the late Dr. Hales, may be relied upon in every particular, and it is to be regretted that we have not more particulars concerning his useful Life from the same hand. On Sunday the 4th instant, died, at his parsonage-house at Tedington, universally lamented, in the 83rd year of his age, the Rev. Dr. Stephen Hales, F. R. S., member of the royal academy of sciences at Paris and clerk of the closet to her Royal Highness the Princess Dowager of Wales. If any man might ever be said to have devoted his whole life to the public, to all mankind, it was Dr. Hales. He possessed a native innocence and simplicity of manners, which the characters of other men, and the customs of the world, could never alter; and though he often met with many unworthy objects of his kind and charitable offices, yet they never once lessened his natural and unwearied disposition of doing good and relieving distress. His temper, as well as the powers of his understanding, were happily fitted for the improvement of natural philosophy, possessing, as he did, in an uncommon degree, that industry and patient thinking, which Sir Isaac Newton used modestly to declare, was his own only secret by which he was enabled so fortunately to trace the wonderful analysis of nature. Dr. Hales began his inquiries into natural knowledge very early in life, and he continued it uniformly as his darling amusement, being engaged in experiments until within a few weeks of his death. His industry had this farther excellence, that it was always pointed at the general good of his fellow creatures, agreeable to the almost unlimited benevolence of his heart; and being animated with the success of some of his

⁴¹ Courthope: Life of Pope, F. D.

⁴² F. D. In the phrase "Plain parson Hale," (Moral Essays, Epistle II) Pope doubtless refers to Hales whose correct name unfortunately could not be made to rhyme with "fail" in the preceding line.

⁴³ G. M., January, 1761, XXXI, 32.

[191] more useful discoveries, his knowledge appeared to everybody near him to feed his mind with a nourishment which gave him, in the decline of his life, and even in its last stages that vigor and serenity of understanding, and clearness of ideas, which so few possess, even the flower of manhood; and which he used often to say, he valued as the most perfect of human pleasures.

“
“There are two things in his character, which particularly distinguish him from almost every other man; the first was, that his mind was so habitually bent on acquiring knowledge, that, having what he thought an abundant income, he was solicitous to avoid any farther preferment in the church,⁴⁴ lest his time and attention might thereby be diverted from his other favorite and useful occupations.

“The other feature of his character was no less singular: He could look even upon wicked men, and those who did him unkind offices without any emotion of particular indignation; not for want of discernment or sensibility; but he used to consider them only as those experiments which, upon trial, he found could never be applied to any useful purpose, and which he therefore calmly and dispassionately laid aside.”

In accordance with his own directions he was buried in the vestry under the tower of St. Mary's which he had built eight years before. The tablet over his grave tells us that—

“Here is interred the body of Stephen Hales, D. D., clerk of the closet to the Princess of Wales, who was minister in this parish 51 years. He died the 4th of Jan., 1761, in the 84th year of his age.”

In the September number of the *Gentleman's Magazine* of the following year we find this notice:⁴⁵

“Thursday the 2nd was opened in Westminster Abby, a fine new monument,⁴⁶ erected by Mr. John Wilton, statuary to her majesty, at the expense of the Princess Dowager of Wales, to the memory of Stephen Hales, D. D. & F. R. S., Clerk of the closet to the Princess Dowager, minister of Teddington in Middlesex, and rector of Farrington in Hants; grandson of Sir Robert Hales, of Beakesbourne in Kent, Bart. & uncle to the present Sir Thomas Hales. He died in January, 1761, aged 82 years.”

⁴⁴ The King offered Hales the canonry of Windsor which the latter, however, declined. L. L. and P. C.

⁴⁵ G. M., September, 1762, XXXII, 444.

⁴⁶ For epitaph see L. L., III, 507, note 19.

There is, then, a monument to Stephen Hales in Westminster erected by the mother of George II, but it is not by means of this piece of marble that the memory of Stephen Hales is kept green among us. He has left us a memento more unique and enduring in the "Statical Essays" and the Hales manometer. [191] III

BIBLIOGRAPHY.

The more important sources which have been consulted in the preparation of the foregoing article, together with such abbreviations as have been used to designate them in the footnotes, are the following:

1. The separate publications of Hales.
2. Numerous articles by or referring to Hales in the *Philosophical Transactions of the Royal Society of London*, [192] abridged, London, 1809. Designated P. T.
3. Numerous articles by or referring to Hales in the *Gentleman's Magazine*, London. G. M.
4. An especially important article in G. M., June, 1764, XXXIV, 273, entitled, "*Some Account of the Life of the Late excellent and eminent STEPHEN HALES, D. D., F. R. S., Chiefly from Materials communicated by P. COLLINSON, F. R. S.*" P. C.
5. D. Lysons: *Environs of London*, London, 1795, Vol. III. L. L.
6. In a number of instances the author has been unable to reach the original sources and has quoted from the very excellent account of Hales given by Francis Darwin in the *Dict. National Biography*, XXV, 33. Such quotations are designated by the initials F. D. which follow the title of the original source when this is known.
7. Other articles in the *Dict. Nat. Biog.* D. N. B.

